REMARKS

Claims 1-20 are pending in the current application. In an office action dated June 27, 2006 ("Office Action"), the Examiner rejected claims 8 and 9 under 35 U.S.C. § 112, second paragraph, as being indefinite, rejected claims 1, 4-6, 13, and 16-18 under 35 U.S.C. § 102(b) as being anticipated by Shinohara, U.S. Patent No. 5,742,934 ("Shinohara"), rejected claims 1, 4-6, 13, and 16-18 under 35 U.S.C. § 102(b) as being anticipated by Colligan, U.S. Patent Application Publication No. 2002/0065982 ("Colligan"), rejected claims 1, 13, 7, 8, 12, 13, and 19 under 35 U.S.C. § 102(b) as being anticipated by Manka, U.S. Patent No. 5,072,378 ("Manka"), rejected claims 2, 3, 14, and 15 under 35 U.S.C. § 103(a) as being unpatentable over Colligan in view of Sanada et al., U.S. Patent Application Publication No. 2002/0083285 ("Sanada"), and rejected claims 2, 3, 10, 14, and 15 under 35 U.S.C. § 103(a) as being unpatentable over Manka in view of Sanada and further in view of Surugucchi, U.S. Patent No. 6,928,509 ("Surugucchi"). Applicants' representative respectfully traverses the above-listed rejections.

Meaning of the Term "Sector" and the Phrase "Sector Length"

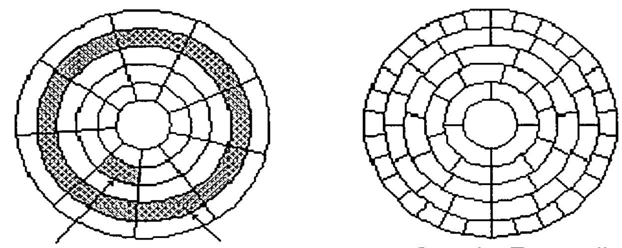
First, because the term "sector" and the phrase "sector length," as applied to magnetic-disk storage devices ("disks"), appears to be again misinterpreted by the Examiner, Applicants' representative provides the following description obtained, by a simple Internet search, from the html link http://www.dewassoc.com/kbase/hard_drives/hard_disk_sector_structures.htm:

Hard Disk Sector Structures

A *sector* is the basic unit of data storage on a hard disk. The term "sector" emanates from a mathematical term referring to that pie shaped angular section of a circle, bounded on two sides by radii and the third by the perimeter of the circle - See Figure 1. An explanation in its simplest form, a hard disk is comprised of a group of predefined sectors that form a circle. That circle of predefined sectors is defined as a single track. A group of concentric circles (tracks) define a single surface of a disks platter. Early hard disks had just a single one-sided platter, while today's hard disks are comprised of several platters with tracks on both sides, all of which comprise the entire hard

disk capacity. Early hard disks had the same number of sectors per track location, and in fact, the number of sectors in each track were fairly standard between models. Today's advances in drive technology have allowed the number of sectors per track, or SPT, to vary significantly, but more about that later.

Figure 1



When a hard disk is prepared with its default values, each sector will be able to store 512 bytes of data. Without elaborating, there are a few operating system disk setup utilities that permit this 512 byte number per sector to be modified, however 512 is the standard, and found on virtually all hard drives by default. Each sector, however, actually holds much more than 512 bytes of information. Additional bytes are needed for control structures, information necessary to manage the drive, locate data and perform other functions. Exact sector structure depends on the drive manufacturer and model, however the contents of a sector usually include the following elements:

- **ID Information:** Within each sector a small space is left to identify the sector's number and location, which is used to locate the sector on the disk and provide for status information about the sector itself. For example, a single bit is used to indicate if the sector has been marked defective and remapped.

- **Synchronization Fields:** These are used internally by the drive controller to guide the read process.

- **Data:** The actual data in the sector.

- **ECC:** Error correcting code used to ensure data integrity.

- **Gaps:** Often referred to as spacers used to separate sector areas and provide time for the controller to process what it has been read before processing additional data.

- **Servo Information:** In addition to the sectors, each of which contain the items above, space on each track is allocated for servo information on drives that

> utilize embedded servo drives. ☑Most, if not all, modern drives not employ servo technology.

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Please note, in particular, the above underlined portion of the description of disk sectors. Disk sectors are generally described as having a length, in bytes. The currently most commonly encountered size for disk sectors is 512 bytes. The length of a disk sector is number of data bytes stored within a sector. However, as noted in the above quoted description, in a different description included in a previous response, in a plethora of introductory computer architecture texts, and in the current application, physical disk sectors actually contain a larger amount of encoded information than the 512 data bytes. In fact, Shinohara clearly defines "sector" to be the data portion of a physical sector, with a length of 512 bytes, and uses the term "block" for the sector plus an additional 16 bytes of ECC data and a validity flag (*see* Shinohara, column 3, lines 58-67 and column 4, lines 45 - 49) created and managed by Shinohara's flash-disk controller. Sector length refers to the data bytes that can be stored into, and read from, a sector by an entity external to the disk drive. The sector length does not include additional information stored with sectors, managed and used by the disk controller, and generally unavailable to external devices. Applicants' representative attempted to clarify this point, in a previous response, using a similar quote and stating:

> Thus, the term "sector size" in the current application refers to data payload size, and not to any additional information stored within sectors, such as error correcting codes, parity bits, and other such non-data-payload information used by the disk-drive controller, but generally inaccessible to external entities.

<u>Meaning of the Terms "Routing," "Router," and the phrase "Routing Component."</u>

Applicants' representative includes portions a detailed discussion of claim interpretation from the recent Federal Circuit decision *Phillips V. Awh Corporation*, decided July 12, 2005:

> A
>
> It is a "bedrock principle" of patent law that "the claims of a patent define the invention to which the patentee is entitled the right to

exclude." Innova, 381 F.3d at 1115; see also Vitronics, 90 F.3d at 1582 ("we look to the words of the claims themselves . . . to define the scope of the patented invention"); Markman, 52 F.3d at 980 ("The written description part of the specification itself does not delimit the right to exclude. That is the function and purpose of claims."). ... Because the patentee is required to "define precisely what his invention is," the Court explained, it is "unjust to the public, as well as an evasion of the law, to construe it in a manner different from the plain import of its terms." White v. Dunbar, 119 U.S. 47, 52 (1886); see also Cont'l Paper Bag Co. v. E. Paper Bag Co., 210 U.S. 405, 419 (1908) ("the claims measure the invention"); McCarty v. Lehigh Valley R.R. Co., 160 U.S. 110, 03-1269, -1286 9 ...

We have frequently stated that the words of a claim "are generally given their ordinary and customary meaning." Vitronics, 90 F.3d at 1582; see also Toro Co. v. White Consol. Indus., Inc., 199 F.3d 1295, 1299 (Fed. Cir. 1999); Renishaw PLC v. Marposs Societa' per Azioni, 158 F.3d 1243, 1249 (Fed. Cir. 1998). We have made clear, moreover, that the ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, i.e., as of the effective filing date of the patent application. See Innova, 381 F.3d at 1116 ("A court construing a patent claim seeks to accord a claim the meaning it would have to a person of ordinary skill in the art at the time of the invention."); Home Diagnostics, Inc. v. LifeScan, Inc., 381 F.3d 1352, 1358 (Fed. Cir. 2004) ("customary meaning" refers to the "customary meaning in [the] art field"); Ferguson Beauregard/Logic Controls v. Mega Sys., LLC, 350 F.3d 1327, 1338 (Fed. Cir. 2003) (claim terms "are examined through the viewing glass of a person skilled in the art"); see also PC Connector Solutions LLC v. SmartDisk Corp., 406 F.3d 1359, 1363 (Fed. Cir. 2005) (meaning of claim "must be interpreted as of [the] effective filing date" of the patent application); Schering Corp. v. Amgen Inc., 222 F.3d 1347, 1353 (Fed. Cir. 2000) (same).

The inquiry into how a person of ordinary skill in the art understands a claim term provides an objective baseline from which to begin claim interpretation. See Innova, 03-1269, -1286 10

381 F.3d at 1116. That starting point is based on the well-settled understanding that inventors are typically persons skilled in the field of the invention and that patents are addressed to and intended to be read by others of skill in the pertinent art. See Verve, LLC v. Crane Cams, Inc., 311 F.3d 1116, 1119 (Fed. Cir. 2002) (patent documents are meant to be "a concise statement for persons in the field"); In re Nelson, 280 F.2d 172, 181 (CCPA 1960) ("The descriptions in patents are not addressed to the public generally, to lawyers or to judges, but, as section 112 says, to those skilled in the art to which the invention pertains or with which it is most nearly connected.").

Importantly, the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification. This court explained that point well in

Multiform Desiccants, Inc. v. Medzam, Ltd., 133 F.3d 1473, 1477 (Fed. Cir. 1998):

> It is the person of ordinary skill in the field of the invention through whose eyes the claims are construed. Such person is deemed to read the words used in the patent documents with an understanding of their meaning in the field, and to have knowledge of any special meaning and usage in the field. The inventor's words that are used to describe the invention—the inventor's lexicography—must be understood and interpreted by the court as they would be understood and interpreted by a person in that field of technology. Thus the court starts the decisionmaking process by reviewing the same resources as would that person, viz., the patent specification and the prosecution history.

See also Medrad, Inc. v. MRI Devices Corp., 401 F.3d 1313, 1319 (Fed. Cir. 2005) ("We cannot look at the ordinary meaning of the term . . . in a vacuum. Rather, we must look at the ordinary meaning in the context of the written description and the prosecution history."); V-Formation, Inc. v. Benetton Group SpA, 401 F.3d 1307, 1310 (Fed. Cir. 2005) (intrinsic record "usually provides the technological and temporal context to
enable the court to ascertain the meaning of the claim to one of ordinary skill in the art at the time of the invention"); Unitherm Food Sys., Inc. v. Swift-Eckrich, Inc., 375 F.3d 1341, 1351 (Fed. Cir. 2004) (proper definition is the "definition that one of ordinary skill in the art could ascertain from the intrinsic evidence in the record").

B

In some cases, the ordinary meaning of claim language as understood by a person of skill in the art may be readily apparent even to lay judges, and claim construction in such cases involves little more than the application of the widely accepted meaning of commonly understood words. See Brown v. 3M, 265 F.3d 1349, 1352 (Fed Cir. 2001) (holding that the claims did "not require elaborate interpretation"). In such circumstances, general purpose dictionaries may be helpful. In many cases that give rise to litigation, however, determining the ordinary and customary meaning of the claim requires examination of terms that have a particular meaning in a field of art. Because the meaning of a claim term as understood by persons of skill in the art is often not immediately apparent, and because patentees frequently use terms idiosyncratically, the court looks to "those sources available to the public that show what a person of skill in the art would have understood disputed claim language to mean." Innova, 381 F.3d at 1116. Those sources include "the words of the claims themselves, the remainder of the specification, the prosecution history, and extrinsic evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art." Id.; see also Gemstar-TV Guide Int'l, Inc. v. Int'l Trade Comm'n, 383 F.3d 1352, 1364 (Fed. Cir. 2004); Vitronics, 90 F.3d at 1582-83; Markman, 52 F.3d at 979-80.

. . .

The claims, of course, do not stand alone. Rather, they are part of "a fully integrated written instrument," Markman, 52 F.3d at 978, consisting principally of a specification that concludes with the claims. For that reason, claims "must be read in view of the specification, of which they are a part." Id. at 979. As we stated in Vitronics, the specification "is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term." 90 F.3d at 1582.

This court and its predecessors have long emphasized the importance of the specification in claim construction. In Autogiro Co. of America v. United States, 384 F.2d 391, 397-98 (Ct. Cl. 1967), the Court of Claims characterized the specification as "a concordance for the claims," based on the statutory requirement that the specification "describe the manner and process of making and using" the patented invention. The Court of Customs and Patent Appeals made a similar point. See In re Fout, 675 F.2d 297, 300 (CCPA 1982) ("Claims must always be read in light of the specification. Here, the specification makes plain what the appellants did and did not invent . . . .").

Shortly after the creation of this court, Judge Rich wrote that "[t]he descriptive part of the specification aids in ascertaining the scope and meaning of the claims 03-1269, -1286 14

inasmuch as the words of the claims must be based on the description. The specification is, thus, the primary basis for construing the claims." Standard Oil Co. v. Am. Cyanamid Co., 774 F.2d 448, 452 (Fed. Cir. 1985). On numerous occasions since then, we have reaffirmed that point, stating that "[t]he best source for understanding a technical term is the specification from which it arose, informed, as needed, by the prosecution history." Multiform Dessicants, 133 F.3d at 1478; Metabolite Labs., Inc. v. Lab. Corp. of Am. Holdings, 370 F.3d 1354, 1360 (Fed. Cir. 2004) ("In most cases, the best source for discerning the proper context of claim terms is the patent specification wherein the patent applicant describes the invention."); see also, e.g., Kinik Co. v. Int'l Trade Comm'n, 362 F.3d 1359, 1365 (Fed. Cir. 2004) ("The words of patent claims have the meaning and scope with which they are used in the specification and the prosecution history."); Moba, B.V. v. Diamond Automation, Inc., 325 F.3d 1306, 1315 (Fed. Cir. 2003) ("[T]he best indicator of claim meaning is its usage in context as understood by one of skill in the art at the time of invention.").

That principle has a long pedigree in Supreme Court decisions as well. See Hogg v. Emerson, 47 U.S. (6 How.) 437, 482 (1848) (the specification is a "component part of the patent" and "is as much to be considered with the [letters patent] in construing them, as any paper referred to in a deed or other contract"); Bates v. Coe, 98 U.S. 31, 38 (1878) ("in case of doubt or ambiguity it is proper in all cases to refer back to the descriptive portions of the specification to aid in solving the doubt or in ascertaining the true intent and meaning of the language employed in the claims"); White v. Dunbar, 119 U.S. 47, 51 (1886) (specification is appropriately resorted to "for the purpose of better

understanding the meaning of the claim"); Schriber-Schroth Co. v. 03-1269, -1286 15

Cleveland Trust Co., 311 U.S. 211, 217 (1940) ("The claims of a patent are always to be read or interpreted in light of its specifications."); United States v. Adams, 383 U.S. 39, 49 (1966) ("[I]t is fundamental that claims are to be construed in the light of the specifications and both are to be read with a view to ascertaining the invention.").

The importance of the specification in claim construction derives from its statutory role. The close kinship between the written description and the claims is enforced by the statutory requirement that the specification describe the claimed invention in "full, clear, concise, and exact terms." 35 U.S.C. § 112, para. 1; see Netword, LLC v. Centraal Corp., 242 F.3d 1347, 1352 (Fed. Cir. 2001) ("The claims are directed to the invention that is described in the specification; they do not have meaning removed from the context from which they arose."); see also Markman v. Westview Instruments, Inc., 517 U.S. 370, 389 (1996) ("[A claim] term can be defined only in a way that comports with the instrument as a whole."). In light of the statutory directive that the inventor provide a "full" and "exact" description of the claimed invention, the specification necessarily informs the proper construction of the claims. See Merck & Co. v. Teva Pharms. USA, Inc., 347 F.3d 1367, 1371 (Fed. Cir. 2003) ("A fundamental rule of claim construction is that terms in a patent document are construed with the meaning with which they are presented in the patent document. Thus claims must be construed so as to be consistent with the specification, of which they are a part.") (citations omitted). In Renishaw, this court summarized that point succinctly:

Ultimately, the interpretation to be given a term can only be determined and confirmed with a full understanding of what the inventors actually invented and intended to envelop with the claim. The construction that stays true to the claim language and most naturally aligns with the patent's description of the invention will be, in the end, the correct construction. 03-1269, -1286 16

158 F.3d at 1250 (citations omitted).

Consistent with that general principle, our cases recognize that the specification may reveal a special definition given to a claim term by the patentee that differs from the meaning it would otherwise possess. In such cases, the inventor's lexicography governs. See CCS Fitness, Inc. v. Brunswick Corp., 288 F.3d 1359, 1366 (Fed. Cir. 2002). In other cases, the specification may reveal an intentional disclaimer, or disavowal, of claim scope by the inventor. In that instance as well, the inventor has dictated the correct claim scope, and the inventor's intention, as expressed in the specification, is regarded as dispositive. See SciMed Life Sys., Inc. v. Advanced Cardiovascular Sys., Inc., 242 F.3d 1337, 1343-44 (Fed. Cir. 2001).

The pertinence of the specification to claim construction is reinforced by the manner in which a patent is issued. The Patent and Trademark

> Office ("PTO") determines the scope of claims in patent applications not solely on the basis of the claim language, but upon giving claims their broadest reasonable construction "in light of the specification as it would be interpreted by one of ordinary skill in the art." In re Am. Acad. of Sci. Tech. Ctr., 367 F.3d 1359, 1364 (Fed. Cir. 2004). Indeed, the rules of the PTO require that application claims must "conform to the invention as set forth in the remainder of the specification and the terms and phrases used in the claims must find clear support or antecedent basis in the description so that the meaning of the terms in the claims may be ascertainable by reference to the description." 37 C.F.R. § 1.75(d)(1). It is therefore entirely appropriate for a court, when conducting claim construction, to rely heavily on the written description for guidance as to the meaning of the claims. 03-1269, -1286 17

The Examiner will hopefully appreciate that nowhere in the Court's discussion of claim interpretation is the phrase "term of art" mentioned. Instead, the Court clearly states that the claims "are generally given their ordinary and customary meaning." and "that the ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention." Moreover, "[t]he claims, of course, do not stand alone. Rather, they are part of 'a fully integrated written instrument,' Markman, 52 F.3d at 978, consisting principally of a specification that concludes with the claims. For that reason, claims 'must be read in view of the specification, of which they are a part.' Id. at 979. As we stated in Vitronics, the specification 'is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term.'"

The term "routing component" cannot be assigned an arbitrary meaning by the Examiner, as the Examiner seems to suggest. In electronics and computing, the term "routing" is used to characterize the function of a device or component that directs each received message or other unit of information to one of multiple different destination devices, often referred to as "targets." A wire that transfers electronic signals from a single source to a single destination, a disk controller controlling a single magnetic-disk assembly, and other entities that transfer received information to a single destination device are not considered to be routers. By contrast, a computer system that receives messages from downstream computers within a network and forwards the received messages to appropriate target computer systems is referred to as a "router."

The specification of the current application uses the terms "router" and "routing" consistently to mean an entity that forwards or transmits information to appropriate targets selected from among multiple possible device destinations. For example, data routing within an FC fabric is discussed in the final paragraph of page 7. As another example, the figure caption for Figures 26A-E indicates that these figures "illustrate the data fields within an FC-frame header that are used for routing FC frames to particular storage-shelf routers or to remote entities via particular FC ports within the storage shelf that represents one embodiment of the present invention," and Figure 27 shows routing tables used to facilitate routing FC frames to appropriate target storage shelves and storage-shelf routers. As yet another example, the final paragraph on page 38 and the paragraph that begins at the bottom of page 48 discuss the routing layer of a storage-shelf router, with the router layer determining where to forward incoming FC frames. Routing is a function carried out by a routing component that selects one of multiple paths by which to transmit received information to a target device and/or one of multiple target devices to which to transmit received information. Whether the Examiner wishes to consider the phrase "routing component" as a "term of art" or not is quite immaterial to how the phrase "routing component" is interpreted within a claim. The phrase "routing component" in computing and electronics refers to a component that selects a path and/or target from among multiple paths and/or targets for forwarding received information. The terms "router" and "routing" are completely consistently used in the current application in consonance with the meaning of "router," "routing component," and "routing" in computing and electronics. Thus, by the principles of claim construction carefully laid out by the Federal Circuit, this is the meaning of "routing component" in the current claims. The phrase "routing component" cannot be defined by the Examiner to mean a component that transmits or sends information to a single destination device. Such an arbitrary definition is completely inconsistent with the meaning of the term "routing" in computer science and electronics and completely inconsistent with its use in the current application.

35 U.S.C. § 112 Rejections

Claims 8 and 9 are not indefinite. Claims 8 and 9 read:

8. (original) A virtual disk formatting system of claim 7 further including:
including, by the routing component, error detection information within the internal-virtual-disk-interface sectors in order to provide routing-component-mediated error checking.

9. (original) The virtual disk formatting system of claim 8 wherein the error detection information is a longitudinal redundancy check code.

The routing component is not a mass storage device. The routing component stores error detection information into the data portion of sectors in order to provide routing-component-mediated error checking. The data portions of disk sectors can contain any type of information that an external entity that writes data to the disk sectors chooses to write. From the mass-storage-devices standpoint, data is data, however the data is used, and whatever the significance ascribed to the data by external entities. The longitudinal redundancy check code written to sectors by the routing component is computed and managed by the routing component, and not by the mass-storage devices. The longitudinal redundancy check code is simply data included in the data portion of a disk sector. ECC data and other information stored and managed by the mass storage device, by contrast, is not considered to be part of the data portion of a sector, and the amount of mass-storage-device information other than the data portion of a sector is not reflected in the sector length, as explained earlier. The two-level virtual method for including and additional longitudinal redundancy check code in the data portion of disk sectors is described in the following paragraph of the specification, beginning on line 18 of page 76:

> Figure 44 illustrates a two-layer virtual disk formatting technique that allows a storage-shelf router to enhance the error-detection capabilities of ATA disk drives. In Figure 44, the ATA disk drives employ 512-byte sectors, indicated by a linear subsequence of sectors 4402 with solid vertical lines, such as solid vertical line 4404, representing 512-byte sector boundaries. The storage-shelf router, as illustrated in Figure 44 by a short subsequence 4406 of 512-byte sectors, uses the above-discussed virtual disk formatting technique to map 520-byte sectors to the underlying disk-drive-supported 512-byte sectors. Each 520-byte virtual sector, such as virtual sector 4408, includes a 512-byte payload and an additional eight-byte longitudinal redundancy code ("LRC") field appended to the 512-byte payload. In other words, the storage-shelf router employs a first virtual disk formatting layer to map 520-byte sectors to underlying 512-byte sectors of ATA disk drives. However, in this embodiment, the storage-shelf router employs a second virtual disk formatting level to map externally visible, 512-byte, second-level-virtual sectors, such as virtual sector 4410, to 520-byte

> first-level-virtual sectors, such as first-level virtual sector 4408, which are in turn mapped by the storage-shelf router to 512-byte disk sectors. This two-tiered virtualization allows the storage-shelf router to insert the additional eight-byte LRC fields at the end of each sector. Although an external processing entity, such as a disk-array controller, interfaces to the second-level virtual disk formatting layer supporting 512-byte sectors, the same formatting used by the disk drives, the external processing entity views less total sectors within a disk drive than the actual number of sectors supported by the disk drive, since the storage-shelf router stores the additional eight-byte LRC fields on the disk drive for each sector. Moreover, the external entity is not aware of the LRC fields included in the disk sectors.

Again, please carefully note Applicants' representative's statement from the previous response:

> Thus, the term "sector size" in the current application refers to data payload size, and not to any additional information stored within sectors, such as error correcting codes, parity bits, and other such non-data-payload information *used by the disk-drive controller, but generally inaccessible to external entities*. (emphasis added)

There is no contradiction. The LRC is not used by the disk-drive controller, and is completely accessible to the routing-component external entity.

<u>35 U.S.C. § 102(b) Rejections</u>

Shinohara does not anticipate any claim of the current application. For example, claim 1 recites:

> 1. A virtual disk formatting system comprising:
>
> a number of mass-storage devices, each having physical sectors of a first sector length; and
>
> a routing component that provides a virtual disk interface to the mass-storage devices by mapping each access operation, received from an external entity, each access operation directed to a virtual disk having virtual sectors of a second sector length, to one of the number of mass-storage devices having physical sectors of the first sector length.

Shinohara does not include a routing component. Shinohara's flash-disk controller merely receives information from a host computer and stores the information in on a single flash memory (4 in Figure 1). Shinohara's flash-disk controller does not provide any kind of virtual-disk formatting. Instead, Shinohara's flash-disk controller

receives 512-byte sectors from the host computers and writes them to the flash memory, and retrieves 512-byte sectors from the flash memory and returns them to the host computer, just like any conventional disk drive. The 16 bytes of ECC and valid-flag data are not considered to be part of the sector, and are not accessible to the host computer. That is why Shinohara carefully distinguishes between 512-byte sectors and 512+16 byte blocks. The host computer access sectors, through standard READ and WRITE operations, of a single size - 512 bytes - just as in a conventional disk system. Shinohara is completely unrelated to the currently claimed invention.

Colligan also does not anticipate, and is unrelated to, the currently claimed invention. Colligan, as clearly stated in the abstract, in paragraph [0008], and throughout Colligan, is directed to a method for matching data transfer rates of a communications medium connecting a disk drive to other components of a computer system to a physical sector size. In Colligan's method, the disk is physically formatted to have sectors of a length that allow for efficient exchange of information between the disk and other computer-system components. There is no virtual disk formatting of any kind discussed or suggested in Colligan. Paragraph [0044], cited by the Examiner, discusses a memory cache that allows rearranging of data stored for sector reading and writing to accommodate reception of communications-medium packets containing 1024 bytes. There is no teaching, suggestion, or mention that Colligan's cache, or any other component of Colligan, accepts READ or WRITE requests directed to a virtual disk having one sector length and maps them into READ and WRITE requests of a different sector length. Packets are communications-medium messages, and are not access operations. Moreover, like Shinohara, Colligan does not teach, mention, or suggest a routing component. Instead, Colligan's adaptable disk-drive controller transmits received information to a single disk-based storage device.

By contrast to Shinohara and Colligan, Manka is related art. However, Manka does not disclose or suggest "a routing component that provides a virtual disk interface to the mass-storage devices by mapping each access operation, received from an external entity, each access operation directed to a virtual disk having virtual sectors of a second sector length, to one of the number of mass-storage devices having physical sectors of the first sector length." Instead, Manka maps a virtual sector of length n x m bytes directed to large physical disk drive (e.g. 109-0 in Figure 1 of

Manka) to physical sectors of length *m* on *n* multiple, small disk drives (e.g. small physical disk drives 211-0 - 211-P in Figure 2 of Manka). This is discussed in the paragraph of Manka beginning on line 9 of column 8 and in the paragraph of Manka beginning on line 34 of column 19 of Manka. By contrast, as clearly claimed in amended claims 1 and 12, and as described in detail in the current application, the claimed virtual formatting system of the present invention maps a virtual sector of a virtual disk to one or two physical sectors of a single mass-storage device. In other words, in the method and system of the present invention, there is a one-to-one correspondence between a virtual disk and a physical disk. This one-to-one correspondence is claimed specifically by the language "mapping each access operation ... directed to a virtual disk having virtual sectors of a second sector length, to *one* of the number of mass-storage devices having physical sectors of the first sector length." As discussed at length in the current application, the current invention can be used to include cheaper, 512-byte ATA disk drives in a storage shelf accessed by a RAID controller that is implemented to access 520-byte FC drives. For example, beginning on line 31 of page 67 of the current application, the current applications stets:

> Virtual disk formatting provides, to external entities such as disk-array controllers, the illusion of a storage shelf containing disk drives formatted to the FC-disk-drive, 520-byte-sector formatting convention, with the storage-shelf router or storage-shelf routers within the storage shelf handling the mapping of 520-byte-sector-based disk-access commands to the 512-byte-sector formatting employed by the ATA disk drives within the storage shelf.

Each ATA disk drive is provided a virtual-disk-interface to the RAID controller. A disk-access operation directed to a virtual 520-byte disk drive is mapped to a single, 512-byte ATA disk drive. Manka maps each virtual sector to multiple, small sectors on multiple disk drives. Thus, Manka does not anticipate the current claims.

<u>35 U.S.C.§ 103(a) Rejections</u>

The 35 U.S.C.§ 103(a) rejections are based on incorrect premises. In the first set of 35 U.S.C.§ 103(a) rejections, the Examiner states that "Colligan discloses all limitations of the parent claims." Colligan is unrelated to the current claims, as discussed above. Neither Colligan, nor Colligan in combination with other

cited references, makes any of the current claims obvious or unpatentable. In the second set of 35 U.S.C.§ 103(a) rejections, the Examiner states that "Manka discloses all limitations of the parent claims." While Manka is related to the currently claimed subject matter, Manka discloses a very different type of system on which the current claims cannot be read. As discussed above, Manka essentially partitions a large-physical-disk sector into multiple, equally-sized small-physical-disk sectors that are written concurrently to multiple small physical disk drives that are rotationally synchronized. By contrast, a virtual sector is mapped to a single physical disk drive by methods and systems of the present invention, as clearly claimed in independent claims 1 and 12. Neither Manka, nor Manka in combination with other cited references, makes any of the current claims obvious or unpatentable.

Two-Level Virtualization

Finally, independent claims 7 and 19, and the claims that depend from them, are directed to a two-level virtualization of sector lengths, as discussed in the current application beginning on line 18 of page 76 and illustrated by Figure 44. A first level of virtualization is used to increase the size of sectors so that an LRC code introduced and managed by the routing component can be included in the data-portion of the longer sectors, and the longer, first-level virtual sectors are then mapped to physical sectors by a second virtualization level. Applicants' representative can find nothing related to two-level virtualization in any of the cited references.

In Applicant's representative's opinion, all of the claims remaining in the current application are clearly allowable. Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,
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